QingYuan—a GreenLab based plant simulator and solver

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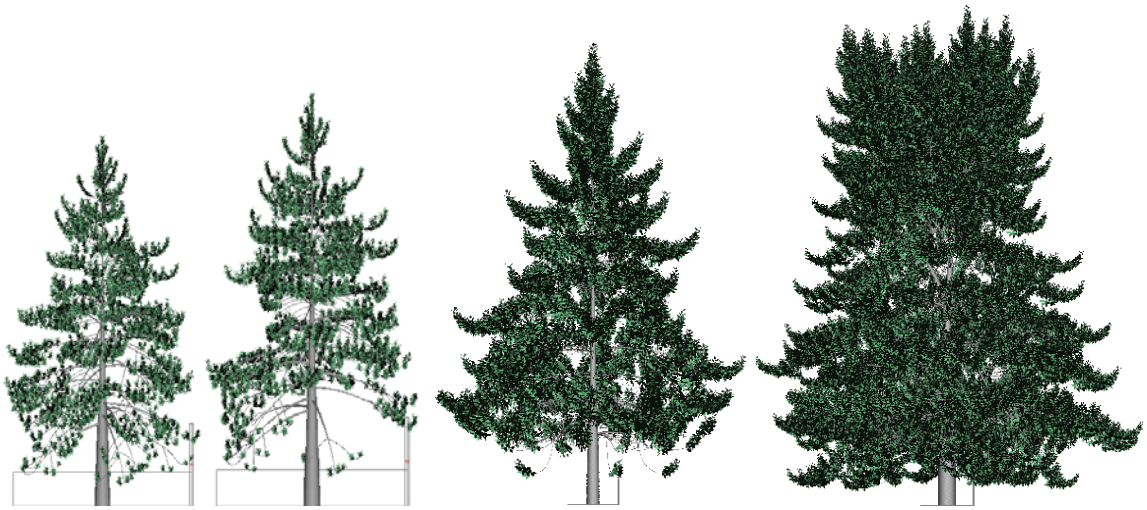
Key words: FSPM, software development, GreenLab, c++, stochastic substructure

Abstract: GreenLab is a stochastic FSPM simulating the interaction between organogenesis and growth. There has been the deterministic model (GL1), model with stochastic bud activities (GL2), deterministic model with feedback of plant functioning on development (GL3). None of previous software implemented both the stochastic and feedback model. This motivated the development of a new software, QingYuan, named after the Chinese name of GreenLab model.

Written in c++, QingYuan implements the basic deterministic GreenLab, common with previous software, including simulation of plant topological structure with a dual-scale automaton, computing organ biomass and size using sink-source approach, 3D output, and especially, identification of hidden model parameters according to measured target data. Its features include implementation of both GL2 and GL3, computing plant structure efficiently with incremental stochastic structure method, and a user-friendly interface written in QT. As QingYuan is a versatile and efficient plant software, with more test, it can be used for building plant library, parameter optimization, parameter identification, and optimal control.



(a) (b) (c) (d)

Fig. 1 Simulation of trees in QingYuan software. (a) and (b) are two stochastic pine trees with the same bud probabilities. (c) and (d) are two poplar trees with bound projection area being 5 m^2 and 12 m^2 respectively; (d) contains 121,060,000 organs, and the simulation time is 2 seconds.

Reference

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